firing," compiled in "drill book" style, but illustrated with most excellent diagrams, which are almost self-explanatory, is a section on grenade tactics. A description of French and German grenades follows, and then a section on explosives used in grenades. Here the author might well have been more explicit; in an attempt to be concise much of the information has been too condensed to be clear. We read, for example: "Picric acid. A yellow crystalline prepared from coal tar. A by-product of gas manufacture." Again: "Lyddite or picric acid. Consists of melted and solidified picric acid. Vaseline is used to melt it." The alternative for benzol is given as benzine. Under cordite no reference is made to M.D., but only to the old Mark I., and the nitroglycerine content of this is wrongly stated. The acetone used for incorporation is described as merely "acetone to harden."

The practical part of the book will no doubt be of assistance to students of grenade work; it is essentially a soldier's book, but its value would have been greater had the author not attempted to impart information in too few words.

Therapeutic Immunisation: Theory and Practice. By Dr. W. M. Crofton. Pp. 224. (London: J. and A. Churchill, 1918.) Price 7*s.* 6*d.* net.

IN the earlier chapters of this book the author surveys the processes underlying immunity, and describes the preparation and properties of toxins and antitoxins and the agglutination and precipitin reactions. The principles of therapeutic immunisation by means of vaccines are then considered, and finally the practical applications of therapeutic immunisation to diseases of the alimentary canal, the respiratory system, and other regions of the body are described. The author's system does not appear to differ essentially from the customary routine, with the exception that in some instances he advocates the continuance of treatment until very large doses of vaccine are reached, *e.g.* 30,000 million cocci in the case of some staphylococcic infections. The use of various iodine preparations is also recommended as an adjunct to vaccine treatment in some infections. For the treatment of tuberculosis, tuberculins made by extraction with benzoyl chloride, which is a solvent for the waxy constituent of the tubercle bacillus, are considered to be superior to the ordinary tuberculins.

In addition to vaccine *treatment,* the use of vaccines for *prevention* is also considered where they are applicable, as in the cases of typhoid fever, cholera, plague, etc.

The book gives a useful summary of the practice of vaccine treatment. The practical details of the isolation of the micro-organisms concerned and the preparation of the vaccines therefrom are, however, scarcely touched upon. Full directions are given for the dosage of vaccines and for the proper spacing of the doses, and these will be found very useful by the practitioner who is adopting vaccine treatment. R. T. H.

LETTERS TO THE EDITOR.

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The Stimulation of Plant-growth by Electric Fields.

IN his letter on the above subject in NATURE of March 7 "J. L." states that "the procedure suggests that it is the field of force that is expected to produce the stimulation. The comparatively trifling amount of electricity that leaks from the wires into the atmosphere could scarcely produce directly any sensible effect." It is perfectly clear, however, that Lemström—the professor of physics at Helsingfors who started about thirty years ago the modern phase of electro-culture with overhead wires—held the view that the current leaking from the wires and passing through the plant was responsible for the effects on plant growth which he describes. For the purpose of increasing the discharge he used fine wires, 0·6 mm. in diameter, placed only 40 cm. above the plants, and provided with "barbs" 2 cm. long. In similar experiments in this country the fine wires have been retained, though the "barbs" are usually dispensed with.

It is true that our knowledge of the effects of electricity on plant growth is practically *nil,* and that the currents in question are very small, being of the order of 1 milliamp. per acre in some recent experiments with wires about 7 ft. high. It is, however, not unplausible to assume, although, of course, there are other possibilities, that the passage through the plant of such minute currents may alter the rate of some of its metabolic processes, and so affect plant growth.

In the experiment suggested by "J. L.," where the overhead wire is supposed to be protected from leakage, as, for example, by encasing it in a solid dielectric, it is not clear that a discharge from the pointed aerial portions of the plant would continue unaltered. Although a strong wind may prevent a large part of this discharge from passing to the dielectric enclosing the wire, such a wind will scarcely be able to prevent other atmospheric ions from being attracted to its outer surface. Air currents, in fact, will bring such ions to the dielectric on which they will form a gradually increasing charge tending to weaken the electric field between the wire and the crop. If the overhead wire be bare, but of large gauge so that leakage from it is small, and its potential be increased to such a value that a discharge occurs from the plants, then, with a strong wind, the current passing through the crop may be very much greater than that leaking from the wires.

V. H. B.
G. W. O. H.

Does the Indigenous Australian Fauna Belong to the Tertiary?

THE statement that the indigenous mammalian fauna of Australia belongs to the Mesozoic has been so frequently made that it has come to be generally accepted. It was, therefore, not surprising to find the reviewer of Cleland's "Geology," in NATURE of August 2, 1917 (vol. xcix., p. 441), pointing out as a mistake the opinion expressed in that text-book that the fauna is a Tertiary one.

In order to ascertain the opinion of vertebrate palæontologists on this point, letters were sent to Messrs. J. W. Gidley, W. D. Matthew, and S. W. Williston.

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All agree that the indigenous Australian mammalian fauna should be considered a Tertiary one.

"The Mesozoic marsupials were probably exceedingly generalised or primitive in type throughout their whole structure, whereas the numerous widely diversified forms of present-day Australian marsupials show a high degree of structural specialisation which can only be considered modern in character. The fauna of the early Tertiary, so far as we know it from the very imperfect fossil records, contains relatively few marsupials, and there seems to be as marked differences between these and their living relatives as between placentals of that time and their living relatives. Morphologically, therefore, I should consider the Australian fauna quite modern." (J. W. Gidley.)

Dr. W. D. Matthew states that "the amount of diversity among Eocene mammals is not greater than the amount among modern marsupials," and thinks "one can fairly say that the amount of adaptive specialisation among modern marsupials compares fairly well with that of Eocene placentals." Moreover, the brain development and teeth afford other evidence. The brains of Eocene mammals are fairly comparable with those of Australian marsupials, and the teeth have about the same stage of molar specialisation as Eocene placentals. The predaceous marsupials of Australia are also still in the Eocene stage, such as is seen in the Eocene Creodonts. The skeletal adaptations of the Australian fauna are comparable with the more primitive Eocene and Oligocene specialisations.

The continent of Australia seems to have been isolated either before the placentals reached that continent, or, possibly, some predaceous marsupial destroyed the early arrivals. The evidence points to the Basal Eocene as the time during which occurred the submergence which separated Australia from the other continents of the world. H. F. Cleland.

Williams College, Department of Geology,
Williamstown, Mass., February 15.

THE BOMBARDMENT OF PARIS BY LONG-RANGE GUNS.

In the language of sport, the German gunner has "wiped the eye" of our artillery science and defied all the timid preconceived notions of our old-fashioned traditions. The Jubilee long-range artillery experiments of thirty years ago were considered the *ne plus ultra* of our authorities, and we were stopped at that, as they were declared of no military value. To-day we have the arrears to make up of those years of delay. But the German watched our experiments with great interest, resumed them where we had left off, and carried the idea forward until it has culminated to-day in his latest achievement in artillery of a gun to fire 75 miles and bombard Paris from the frontier.

From a measurement of the fragments of a shell a calibre is inferred of 240 mm., practically the same as the 9·2 in. of our Jubilee gun, which, firing a shell weighing 380 lb. at elevation 40°, with muzzle velocity nearly 2400 ft. per sec., gave a range of 22,000 yards—say, 12 miles. This was much greater than generally anticipated, but in close agreement with the previous calculations of Lieut. Wolley Dod, R.A., who had allowed carefully for the tenuity of the air while the shot was flying for the most part 2 or 3 miles high.

The German shell is likely to be made much heavier and very nearly a solid shot, better by its weight to overcome air resistance, the chief factor to be considered in the problem of the trajectory. If it was not for this air resistance a range of 75 miles with 45° elevation could be reached, on the old parabolic theory of Galileo, with so moderate a velocity as $V = \sqrt{(gR)} = 3200$ ft. per sec., with $g = 32{\cdot}2$, $R = 75 \times 5280$; in a time of flight of about $2\frac{1}{2}$ mins., an average speed over the ground of 30 miles per min.

A velocity of 3200 ft. per sec. was obtained by Sir Andrew Noble in his experiments at Newcastle about twenty years ago with a 6-in. 100-calibre gun, with a charge of $27\frac{1}{2}$ lb. of cordite and a shot of unspecified weight, so it may have been the usual 100 lb. or perhaps an aluminium shot of half the weight.

Double velocity is usually assumed to carry twice as far; at this rate the velocity of our gun would require to be raised from 2400 ft. to about 6000 ft. per sec. to increase the range from 12 to 75 miles; such a high velocity must be ruled out as unattainable with the material at our disposal.

But in this range of 75 miles the German shot would reach a height of more than 18 miles and would be travelling, for the most part in air so thin as to be practically a vacuum, and little resistance would be experienced.

So it is possible a much lower velocity has been found ample, with the gun elevated more than 45°, for the shot to clear quickly the dense ground strata of the atmosphere. Even with the 3200 ft. per sec. velocity obtained by Sir Andrew Noble a surprising increase in range can be expected over the 12-mile Jubilee range when this extra allowance of tenuity is taken into account, and a range of 60 miles be almost attainable.

A committee should be formed at once, composed of the artillery experts available, theoretical and practical, to make a start to recover our lost ground. If these long-range guns are now mounted afloat our Fleet is outclassed and cannot return their fire. A start could be made with no delay on one of our present 9-in. guns, strengthening the breech with wire coil and lengthening it with a chase of tubes screwed together, as in the Noble experimental 6-in. gun, to a length of something like 80 ft.

With a charge of 100 lb. of the newest powder to a shot weighing 400 lb., Sir Andrew Noble's velocity should be reached and exceeded and a comparison be drawn between calculation and practice. Meanwhile experiments on the model scale should not be despised, as they will give rapid and economical results, from which it is possible to predict a full-scale performance on the laws of mechanical similitude.

With the extra metal for strengthening the breech the gun would be heavy enough to prevent the recoil becoming unmanageable; and if the long chase should be too flexible, droop, and whip, it can be rigged like the bowsprit of a ship.

We can rely on our chemical, metallurgical, and

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